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PO/SCF	Submittal	Rev



Bechtel National, Inc.

Job No. 24590

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Supersedes BNI Document No. <u>N/A</u> Rev. _____ [When applicable:]									
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SUBCONTRACT SUBMITTAL

**IQRPE REVIEW
OF
THE PRETREATMENT FACILITY (PTF)
CESIUM NITRIC ACID RECOVERY PROCESS (CNP)
MISCELLANEOUS TREATMENT UNIT SYSTEMS**

"I, Tarlok Hundal, have reviewed, and certified a portion of the design of a new tank system or component located at the Hanford Waste Treatment Plant, owned/operated by Department of Energy, Office of River Protection, Richland, Washington. My duties were independent review of the current design for the Pretreatment Facility (PTF) Cesium Nitric Acid Recovery Process (CNP) Miscellaneous Treatment Unit Systems as required by the Dangerous Waste Regulations, namely, WAC 173-303-640(3) applicable paragraphs, i.e., (a) through (g)."

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

The documentation reviewed indicates that the design intent fully satisfies the requirements of the WAC.

The attached review is ten (10) pages numbered one (1) through ten (10).



T. Hundal
Signature

10/7/04
Date

24590 - CM - HCL4 - HXYG7 - 00138 - 02 - 00045 Rev. 006

**STRUCTURAL INTEGRITY ASSESSMENT
OF
THE PRETREATMENT FACILITY (PTF)
CESIUM NITRIC ACID RECOVERY PROCESS (CNP)
MISCELLANEOUS TREATMENT UNIT SYSTEMS**

**COGEMA-IA-070
REV. 1**

Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the U.S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

		<p>This integrity assessment includes the following Miscellaneous Treatment Units (MTUs) for the PTF Cesium Nitric Acid Recovery Process System (CNP), located in various cells/rooms of the PTF building:</p> <ol style="list-style-type: none">1. Cesium Evaporator Separator Vessel (CNP-EVAP-00001) and Cesium Evaporator Concentrate Reboiler (CNP-HX-00001) as shown on drawing 24590-PTF-M6-CNP-P0008.2. Cesium Evaporator Nitric Acid Rectifier (CNP-DISTC-00001) and Cesium Evaporator Primary Condenser (CNP-HX-00002), Cesium Evaporator Inter-Condenser (CNP-HX-00003), and Cesium Evaporator After-Condenser (CNP-HX-00004) as shown on drawing 24590-PTF-M6-CNP-P0010. <p><u>Note:</u> In this report, the above listed MTUs will interchangeably be referred to as Plant Items and for simplicity each unit will be called as below:</p> <table><tr><td>Cesium Evaporator Separator Vessel :</td><td>Separator</td></tr><tr><td>Cesium Evaporator Concentrate Reboiler :</td><td>Reboiler</td></tr><tr><td>Cesium Evaporator Nitric Acid Rectifier:</td><td>Rectifier</td></tr><tr><td>Cesium Evaporator Primary Condenser :</td><td>Primary Condenser</td></tr><tr><td>Cesium Evaporator Inter-Condenser :</td><td>Inter-Condenser</td></tr><tr><td>Cesium Evaporator After-Condenser:</td><td>After-Condenser.</td></tr></table>	Cesium Evaporator Separator Vessel :	Separator	Cesium Evaporator Concentrate Reboiler :	Reboiler	Cesium Evaporator Nitric Acid Rectifier:	Rectifier	Cesium Evaporator Primary Condenser :	Primary Condenser	Cesium Evaporator Inter-Condenser :	Inter-Condenser	Cesium Evaporator After-Condenser:	After-Condenser.
Cesium Evaporator Separator Vessel :	Separator													
Cesium Evaporator Concentrate Reboiler :	Reboiler													
Cesium Evaporator Nitric Acid Rectifier:	Rectifier													
Cesium Evaporator Primary Condenser :	Primary Condenser													
Cesium Evaporator Inter-Condenser :	Inter-Condenser													
Cesium Evaporator After-Condenser:	After-Condenser.													
Scope of this Integrity Assessment														
Scope														
	Summary of Assessment	<p>For each item of "Information Assessed" (i.e., Criteria) on the following pages, the items listed under "Source of Information" were reviewed and found to furnish adequate design controls and requirements to ensure the design intent fully satisfies the requirements of Washington Administrative Code, WAC-173-303-640, <i>Dangerous Waste Regulations</i> for Tank Systems.</p>												

References	Material Requisition, Specifications, and Drawings.	<p>Material Requisition:</p> <p>24590-QL-MRA-MEVV-00002, Rev. 1, including MRS Nos. S01, S0002, S0003, and S0004 to Rev. 1 of the MR.</p> <p>The following Specifications with their appropriate number and revision are included in the above listed Material Requisition:</p> <p>Engineering Specification for Pressure Vessel Design and Fabrication; Engineering Specification for Seismic Qualification Criteria for Pressure Vessels; Engineering Specification for Shell and Tube Heat Exchangers; Specification for Welding of Pressure Vessels, Heat Exchangers, and Boilers; General Specification for Supplier Quality Assurance Program Requirements; Specification for Positive Material Identification (PMI); General Specification for Packing, Shipping, Handling, and Storage; Engineering Specification for Pressure Vessel Fatigue Analysis; Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks; Engineering Specification for Forced Circulation Vacuum Evaporator System; Engineering Specification for Cesium Nitric Acid Recovery Forced Circulation Vacuum Evaporator System.</p> <p>Drawings:</p> <p>24590-PTF-M6-CNP-P0008, Rev. 1, P&ID – PTF Cesium Nitric Acid Recovery Process System Evaporator Vessel; 24590-PTF-M6-CNP-P0010, Rev. 1, P&ID – PTF Cesium Nitric Acid Recovery Process System Rectifier and Condensers; 24590-PTF-M5-V17T-P0014, Rev. 1, Process Flow Diagram Cesium Nitric Acid Recovery Process System CNP. 24590-PTF-P1-P01T-P0001, Rev. 4, Pretreatment Facility General Arrangement Plan at El. 0' -0"; 24590-PTF-P1-P01T-P0002, Rev. 2, Pretreatment Facility General Arrangement Plan at El. 28' -0"; 24590-PTF-P1-P01T-P0003, Rev. 0, Pretreatment Facility General Arrangement Plan at El. 56' -0"; 24590-PTF-P1-P01T-P0004, Rev. 0, Pretreatment Facility General Arrangement Plan at El. 77' -0"; 24590-PTF-P1-P01T-P0009, Rev. 8, Pretreatment Facility General Arrangement Sect. C-C; 24590-PTF-P1-P01T-P0010, Rev. 5, Pretreatment Facility General Arrangement Sect. D-D; 24590-PTF-P1-P01T-P0015, Rev. 7, Pretreatment Facility General Arrangement Sect. M-M and Sect. N-N.</p>
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References	System Description:
System Description, Mechanical Data Sheets, and Plant Item Material Selection Data Sheets	<p>24590-PTF-3YD-CNP-00001, Rev. 0, System Description for Cesium Nitric Acid Recovery Process - System CNP (including SDCN No. 24590-PTF-3YN-CNP-00001).</p> <p>Mechanical Data Sheets:</p> <p>24590-PTF-MWD-CNP-00001, Rev. 2, Mechanical Data Sheet: Cesium Evaporator Nitric Acid Rectifier (CNP-DISTC-00001);</p> <p>24590-PTF-MED-CNP-00003, Rev. 2, Mechanical Data Sheet: Cesium Evaporator Primary Condenser (CNP-HX-00002);</p> <p>24590-PTF-MED-CNP-00004, Rev. 3, Mechanical Data Sheet: Cesium Evaporator After-Condenser (CNP-HX-00004);</p> <p>24590-PTF-MED-CNP-00005, Rev. 2, Mechanical Data Sheet: Cesium Evaporator Concentrate Reboiler (CNP-HX-00001);</p> <p>24590-PTF-MVD-CNP-00006, Rev. 3, Mechanical Data Sheet: Cesium Evaporator Separator Vessel, (CNP-EVAP-00001);</p> <p>24590-PTF-MED-CNP-00010, Rev. 1, Mechanical Data Sheet: Cesium Evaporator Inter-Condenser (CNP-HX-00003).</p> <p>Plant Item Material Selection Data Sheets:</p> <p>24590-PTF-NID-CNP-P0001, Rev. 0, Plant Item Material Selection Data Sheet, CNP-DISTC-00001 (PTF) Cs Evaporator Nitric Acid Rectifier;</p> <p>24590-PTF-NID-CNP-P0002, Rev. 0, Plant Item Material Selection Data Sheet, CNP-HX-00002 (PTF) Cs Evaporator Primary Condenser;</p> <p>24590-PTF-NID-CNP-P0003, Rev. 0, Plant Item Material Selection Data Sheet, CNP-HX-00003 (PTF) Cs Evaporator Inter-Condenser;</p> <p>24590-PTF-NID-CNP-P0004, Rev. 0, Plant Item Material Selection Data Sheet, CNP-HX-00001 (PTF) Cs Evaporator Concentrate Reboiler;</p> <p>24590-PTF-NID-CNP-P0005, Rev. 0, Plant Item Material Selection Data Sheet, CNP-EVAP-00001 (PTF) Cs Evaporator Separator Vessel;</p> <p>24590-PTF-NID-CNP-P0012, Rev. 0, Plant Item Material Selection Data Sheet, CNP-HX-00004 (PTF) Cs Evaporator After-Condenser.</p>

Information Assessed	Source of Information	Assessment
<p>Design</p> <p>Plant Item design standards are appropriate and adequate for the Plant Item's intended use.</p>	<p>Drawings, Specifications, and Mechanical Data Sheets listed above under References;</p> <p>American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel (B & PV) Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels;</p> <p>TEMA Standards, 8th Edition, Standards of the Tubular Exchanger Manufacturers Association, Inc.</p>	<p>The Engineering Specification for Cesium Nitric Acid Recovery Forced Circulation Vacuum Evaporator System requires that all MTUs are to be designed in accordance with the requirements specified in the Engineering Specification for Pressure Vessel Design and Fabrication. This specification requires that all the MTUs are to be designed to ASME B & PV Code, Section VIII, Division 1. Supplementary design requirements for the shell and tube heat exchangers are specified in the Engineering Specification for Shell and Tube Heat Exchangers and TEMA Standards. These design requirements are appropriate for the unfired MTUs operating with mixed waste solutions over the pressure and temperature ranges specified for these Plant Items. Supplementary requirements listed in the Engineering Specification for Cesium Nitric Acid Recovery Forced Circulation Vacuum Evaporator System address pressure vessel fatigue analysis, positive material identification, standard fabrication tolerances, acceptable welding procedures for the MTUs and appurtenances, welder qualifications and testing records, NDE inspections and records, quality assurance requirements, and packaging, shipping, handling and storage requirements. Mechanical Data Sheets and drawings specify that all MTUs are to be designed and fabricated to Seismic Category (SC-I) and Quality Level (QL-1) requirements. Seismic Categories and Quality Levels are discussed in the Engineering Specification for Pressure Vessel Design and Fabrication. Code stamps and National Board Registration are to be provided for all MTUs. These codes and standards are acceptable and adequate for the design of the MTUs for their intended use.</p>

Information Assessed		Source of Information	Assessment
Design	<p>If the Plant Item to be used is not built to a design standard, the design calculations demonstrate sound engineering principles of construction.</p>	<p>Specifications and Mechanical Data Sheets listed above under References;</p> <p>American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel (B & PV) Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels.</p>	<p>The Mechanical Data Sheets require Plant Item pressure containment boundary design to be compliant with that of ASME B & PV Code, Section VIII, Division 1, and code stamped. The Engineering Specification for Pressure Vessel Design and Fabrication requires that these ASME B & PV Code, Section VIII, Division 1 items be delivered after design, fabrication, inspection and testing with ASME stamps and that the items be registered with the National Board. These are shop fabricated items for mixed waste service in the Pretreatment Facility. The design standards identified above are appropriate and adequate for these MTUs.</p>
	<p>Plant Item has adequate strength at the end of its design life to withstand the operating pressure, operating temperature, thermal expansion, and seismic loads. Equipment is protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.</p>	<p>Specifications listed above under References;</p> <p>American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel (B & PV) Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels.</p>	<p>The Engineering Specification for Cesium Nitric Acid Recovery Forced Circulation Vacuum Evaporator System requires that all the MTUs are to be designed in accordance with the requirements specified in the Engineering Specification for Pressure Vessel Design and Fabrication. This specification requires that all MTUs are to be designed to ASME B & PV Code, Section VIII, Division 1. These specifications and codes require consideration of the operating pressures, temperatures, thermal expansion, seismic loads, and corrosion allowance in the design process. Supplementary general seismic design criteria are specified in the Engineering Specification for Seismic Qualification Criteria for Pressure Vessels to provide for the Plant Item seismic design analysis. Detailed seismic design analysis information is provided in the Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks. These are appropriate requirements and criteria to ensure the Plant Items have adequate strength to withstand all loads for the specified design life of 40 years.</p>

<p>Pretreatment Facility (PTF) Cesium Nitric Acid Recovery Process System (CNP)</p> <p>Miscellaneous Treatment Units</p>	<p>COGEMA-IA-070, Rev. 1</p>
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Information Assessed	Source of Information	Assessment
<p>Plant Item foundation will maintain the load of a full Plant Item.</p>	<p>Specifications listed above under References;</p> <p>American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel (B & PV) Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels;</p> <p>AISC N690, Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities;</p> <p>24590-WTP-DB-ENG-01-001, Rev. 1B, Basis of Design.</p>	<p>The Engineering Specification for Cesium Nitric Acid Recovery Forced Circulation Vacuum Evaporator System requires all the MTUs to be furnished with support skids to be anchored to embedments on the walls and floors of the process cells and the hot cell. The skids are to be designed in accordance with the requirements of AISC N690. Foundation attachments of the MTUs to the support skids are to be designed in accordance with ASME B&PV Code, Section VIII, Division 1. Chapter 14 of the Basis of Design document requires that the Plant Item foundation design must be adequate to support the loads from full Plant Item. These codes and standards ensure that the equipment foundations will maintain the loads of full MTUs.</p>
<p>If in an area subject to flooding, the Plant Item is anchored.</p>	<p>Specifications listed above under references.</p>	<p>Buoyant forces on an empty Plant Item in a flooded room are a standard design load case in the Specification for Pressure Vessel Design and Fabrication.</p>
<p>Plant Item system will withstand the effects of frost heave.</p>	<p>24590-WTP-DC-ST-01-001, Rev. 3, Structural Design Criteria</p>	<p>The Structural Design Criteria requires that all structural foundations for outdoor equipment to extend a distance below grade that exceeds the 30" depth of the frost line. These Plant Items are located inside/interior of the PTF building. The PTF building foundation mat is 8 ft thick (below grade), therefore, the CNP MTUs located inside the building are not subject to the effects of frost heave.</p>

Miscellaneous Treatment Units

Information Assessed	Source of Information	Assessment
<p>Waste Characteristics</p> <p>Characteristics of the waste to be stored or treated have been identified (ignitable, reactive, toxic, specific gravity, vapor pressure, flash point, temperature)</p>	<p>System Description and Plant Item Material Selection Data Sheets listed above under References;</p> <p>24590-WTP-PER-03-002, Rev. 1, Toxic Vapors and Emissions from WTP Tank Systems and Miscellaneous Treatment Unit Systems;</p> <p>24590-WTP-PER-PR-03-001, Rev. 1, Prevention of Hydrogen Accumulation in WTP Tank Systems and Miscellaneous Treatment Unit Systems;</p> <p>24590-WTP-PSAR-ESH-01-002-02, Rev. 1A, Preliminary Safety Analysis Report (PSAR) to Support Construction Authorization; PT Facility Specific Information.</p>	<p>Chemical characteristics of the wastes treated in the MTUs are discussed in the Material Selection Data Sheets for each MTU. The System Description identifies the safety functions for all CNP MTUs to include primary confinement of the waste during normal operations, upset conditions, and during and after the Design Basis Earthquake event. Waste characteristics that are hazardous, such as ignitability, reactivity, and toxicity are appropriately addressed in the Toxic Vapors and Emissions document and Prevention of Hydrogen Accumulation document. The Prevention of Hydrogen Accumulation document identifies the Separator (CNP-EVAP-00001) as providing primary confinement of waste that pose hydrogen accumulation hazard. The mitigating systems for hydrogen control during normal operations, abnormal operations, and during and after a Design Basis Earthquake are described in above mentioned document. These systems provide appropriate and adequate hydrogen control as discussed in the PSAR.</p>

Information Assessed	Source of Information	Assessment
<p>Waste Characteristics</p> <p>Plant Items are designed to handle the wastes with the characteristics defined above and any treatment reagents.</p>	<p>System Description and Plant Item Material Selection Data Sheets listed above under References.</p>	<p>Plant Items are designed to handle nitric acid solutions, vapor, and acidic condensates for a service life of 40 years as discussed in the Plant Item Material Selection Data Sheets. MTUs operating with more aggressive wastes are specified to be designed and fabricated using more resistant materials. The material specified for the Separator and tube-side of Reboiler is Hastelloy C-22 alloy and shell-side of Reboiler is Hastelloy C-22 and 316 stainless steel (maximum 0.030% C, dual certified), for the Rectifier is UNS N08367/N08926 (6% Molybdenum stainless steel alloy) for the most aggressive waste environments, and for the condensers contacting mildly acidic condensate is 304 stainless steel (maximum 0.030% C, dual certified). System Description document describes that 5M Sodium Hydroxide may be administered as a pH control reagent into the Separator, in order to ensure that nitric acid returned to the ion exchange columns is not overly acidic. All wastes handled in these MTUs are of similar composition as the eluate used for the elution of ion exchange resin columns.</p>

Pretreatment Facility (PTF) Cesium Nitric Acid Recovery Process System (CNP)
Miscellaneous Treatment Units

COGEMA-IA-070, Rev. 1

Information Assessed		Source of Information	Assessment
Corrosion	Plant Item material, and protective coatings ensure the plant item structure is adequately protected from the corrosive effects of the waste stream and external environments. The protection is sufficient to ensure the equipment will not leak or fail for the design life of the system.	Drawings, System Description, Plant Item Material Selection Data Sheets, and Mechanical Data Sheets listed above under References	The Drawings and CNP System Description identify that the Separator is located in a black cell at Elevation 28'-0" (P-0112) in the PTF with a design life of 40 years as routine access is not intended, however, this plant item's head extends to Elevation 56'-0", where the internal mist eliminator may be serviced as discussed in the System Description. The Reboiler is similarly specified for a 40-year design life and is not intended to be routinely serviced, but is placed in the hot cell (P0123) and may be remotely serviced or replaced. Plant Item Material Selection Data Sheets and Mechanical Data Sheets specify materials for these MTUs. The material for Separator and tube-side of Reboiler is specified as Hastelloy C-22 alloy (UNS N06022-high nickel alloy) and for Reboiler shell-side is Hastelloy C-22 and 316 stainless steel (maximum 0.030% C; dual certified). Other CNP MTUs are in R3/C3 areas which are deemed contact maintainable but are also specified for 40-year design life as they are required for continuing operation of the facility. Material specified for Rectifier is UNS N08367/N08926 (6% Molybdenum stainless steel alloy) and for condensers it is 304 stainless steel (maximum 0.030% C; dual certified). The material selections and corrosion allowances adequate and appropriate to ensure that the units will provide the specified service life for the waste streams identified in the Plant Item Material Selection Data Sheets.
	Corrosion allowance is adequate for the intended service life of the Plant Item.	Plant Item Material Selection Data Sheets and Mechanical Data Sheets listed above under References.	Plant Item Material Selection Data Sheets and the Mechanical Data Sheets, specify uniform corrosion allowance of 0.04 in. for 40-year design life for these MTUs. This allowance is adequate for the above specified material for the intended use of these MTUs.

**Pretreatment Facility (PTF) Cesium Nitric Acid Recovery Process System (CNP)
Miscellaneous Treatment Units**

COGEMA-IA-070, Rev. 1

Information Assessed		Source of Information	Assessment
Pressure Relief	Pressure controls (vents and relief valves) are adequately designed to ensure pressure relief if normal operating pressures in the Plant Items are exceeded.	Drawings, System Description, and Mechanical Data Sheets listed above under References.	The System Description document provides a discussion of the normal operating condition for the CNP MTUs as being under vacuum, in order to reduce boiling temperatures of the nitric acid, which is less than the internal and external design pressures listed on the Mechanical Data Sheets for the Plant Items. Vacuum is induced within the Plant items by high pressure steam ejectors acting upon the Primary and Inter-Condensers (CNP-HX-00002 and -00003). Vacuum maintained through the After Condenser (CNP-HX-00004) is provided by the PTF Process Vessel Vent Extraction System (PVV). Although each plant item is designed for full vacuum operation, the pressure control is provided at pressure relief valve (PV-0113) shown on the drawings, which allows filtered facility air into the condenser offgas line prior to the second steam ejector (CNP-EJCTR-00010B) in order to allow operating pressure to increase. This pressure control provides protection for the plant items, and their ancillary equipment as discussed in the Engineering Specification for Cesium Nitric Acid Recovery Forced Circulation Vacuum Evaporator System.
	Plant Item is designed with secondary containment that is constructed of materials compatible with the waste and of sufficient strength to prevent failure (pressure gradients, waste, climatic conditions, daily operations), provided with a leak-detection system, and designed to drain and remove liquids.	Drawings and System Description listed above under References.	The Plant Items considered in this assessment are located in above grade process cells, a central hot cell, and process rooms as shown on the drawings and as described in the System Description document. The Reboiler (CNP-HX-00001) is housed at Elevation 0'-0" in hotcell P-0123; the Separator (CNP-EVAP-00001) is housed in black cell P-0112 at Elevation 28'-0" (to allow its head and mist eliminator to be serviced at Elevation 56'-0"); the Rectifier (CNP-DISTC-00001) is housed in room P-0320 at Elevation 56'-0"; and the three Condensers (CNP-HX-00002, -00003, and -00004) are housed in room P-0430 at Elevation 77'-0". Secondary containment for these Plant Items within the cells and rooms is provided by the steel liners, special protective coatings, and sumps in these areas as appropriate and is outside the scope of this integrity assessment.